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Lee

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[54] **OPENING AND CLOSING APPARATUS OF FOLDING TYPE**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**[7] **E05D 15/28**

[52] **U.S. Cl.** **49/246**

[58] **Field of Search** ..... 49/246, 247, 248, 49/250, 251, 252; 16/93 R

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Primary Examiner—Jerry Redman

Attorney, Agent, or Firm—Hamilton, Brook, Smith & Reynolds, PC

[57] **ABSTRACT**

An opening and closing apparatus of the folding type includes a guiding part, a slider, a first link, and a second link. The guiding part has a guiding protrusion and a guiding bend for longitudinal movement of the slider therein and is fixed on a frame. One side of the first link is hinged to the lower side of the guiding part. The other side of the first link is hinged to the link-connecting portion of the second link. Centering about the link-connecting portion, one side of the second link is hinged with a movable frame and the other side thereof is connected with a rotating part of the slider. The slider has friction-reducing portions to prevent the slider from frictional wear with the guiding protrusion, the guiding bend, and the slider connecting portion. The slider has a locking protrusion for maintaining the apparatus in a closed state.

27 Claims, 8 Drawing Sheets

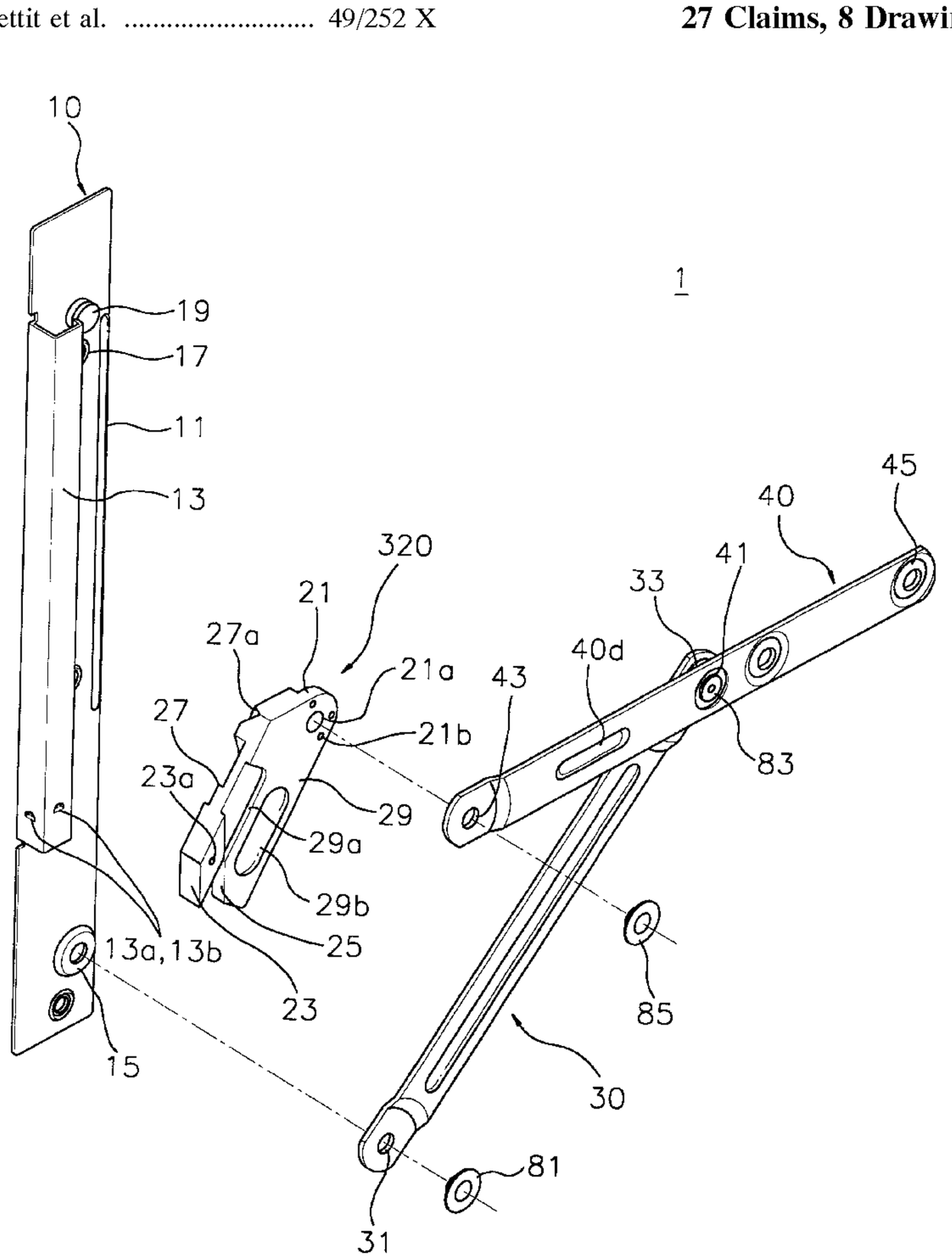


FIG. 1
PRIOR ART

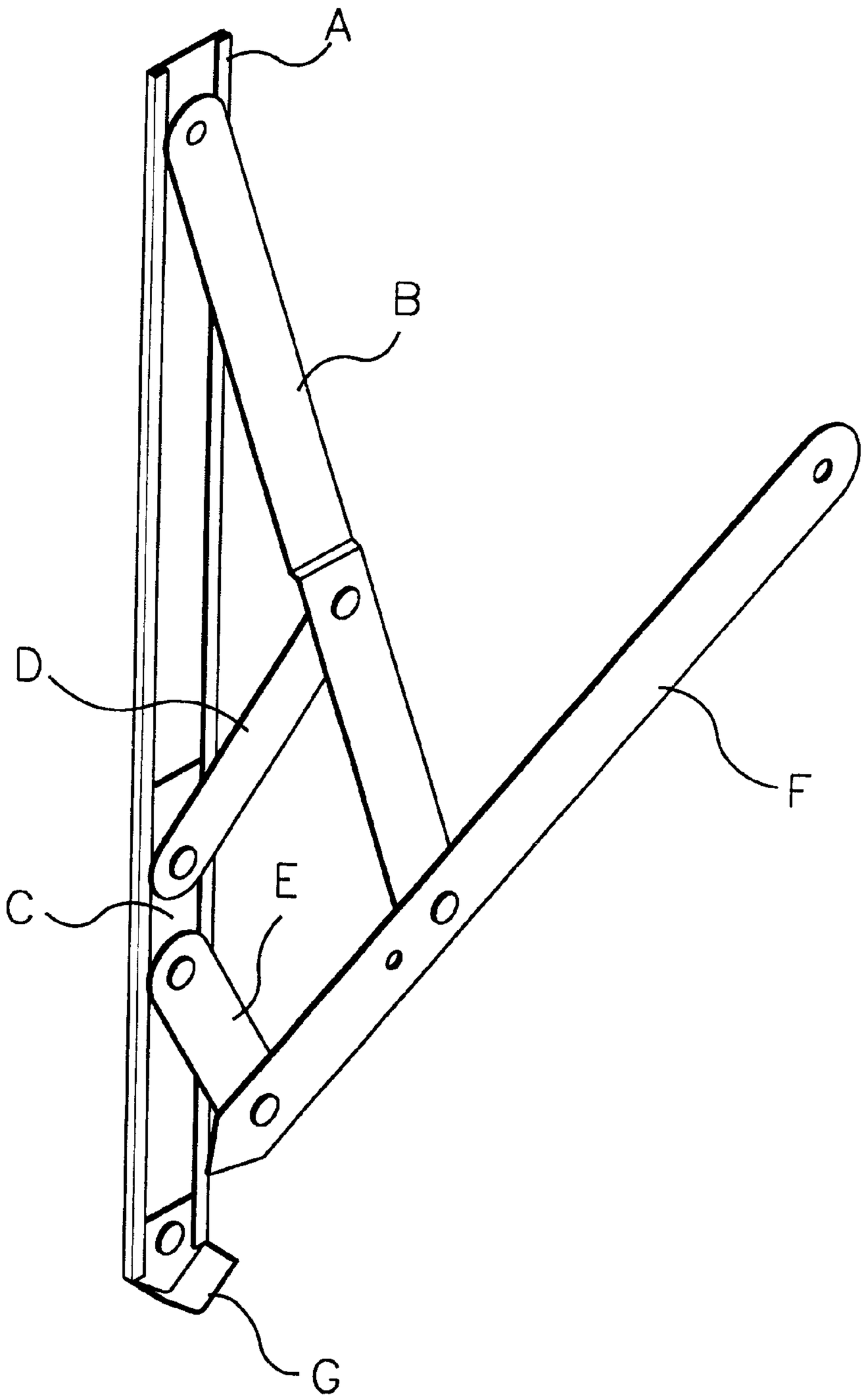


FIG.2

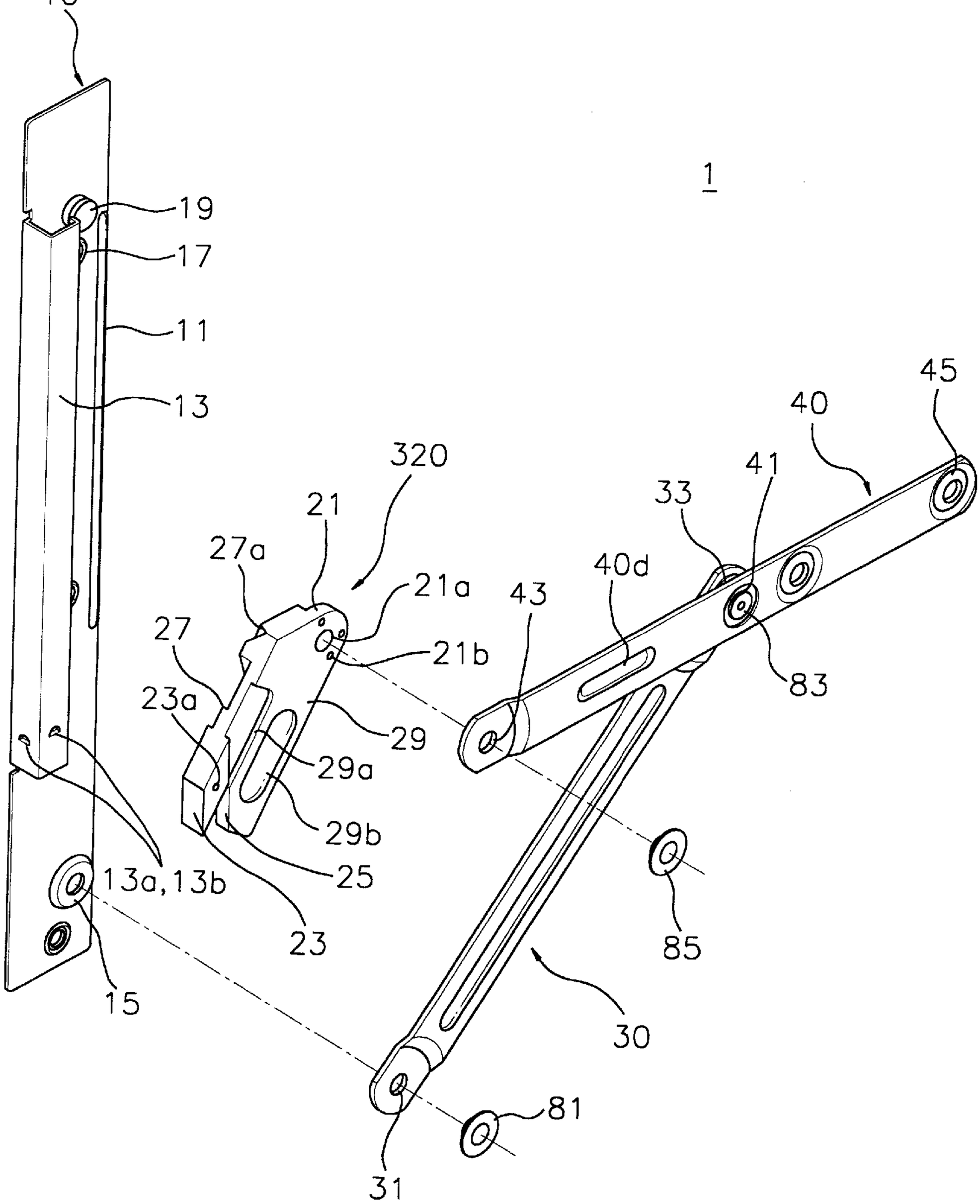

10
19
17
11
13
320
21
27a
21a
27
21b
23a
29
29a
29b
25
13a, 13b
23
15
1
45
40
41
33
40d
43
83
85
30
81
31

FIG.3

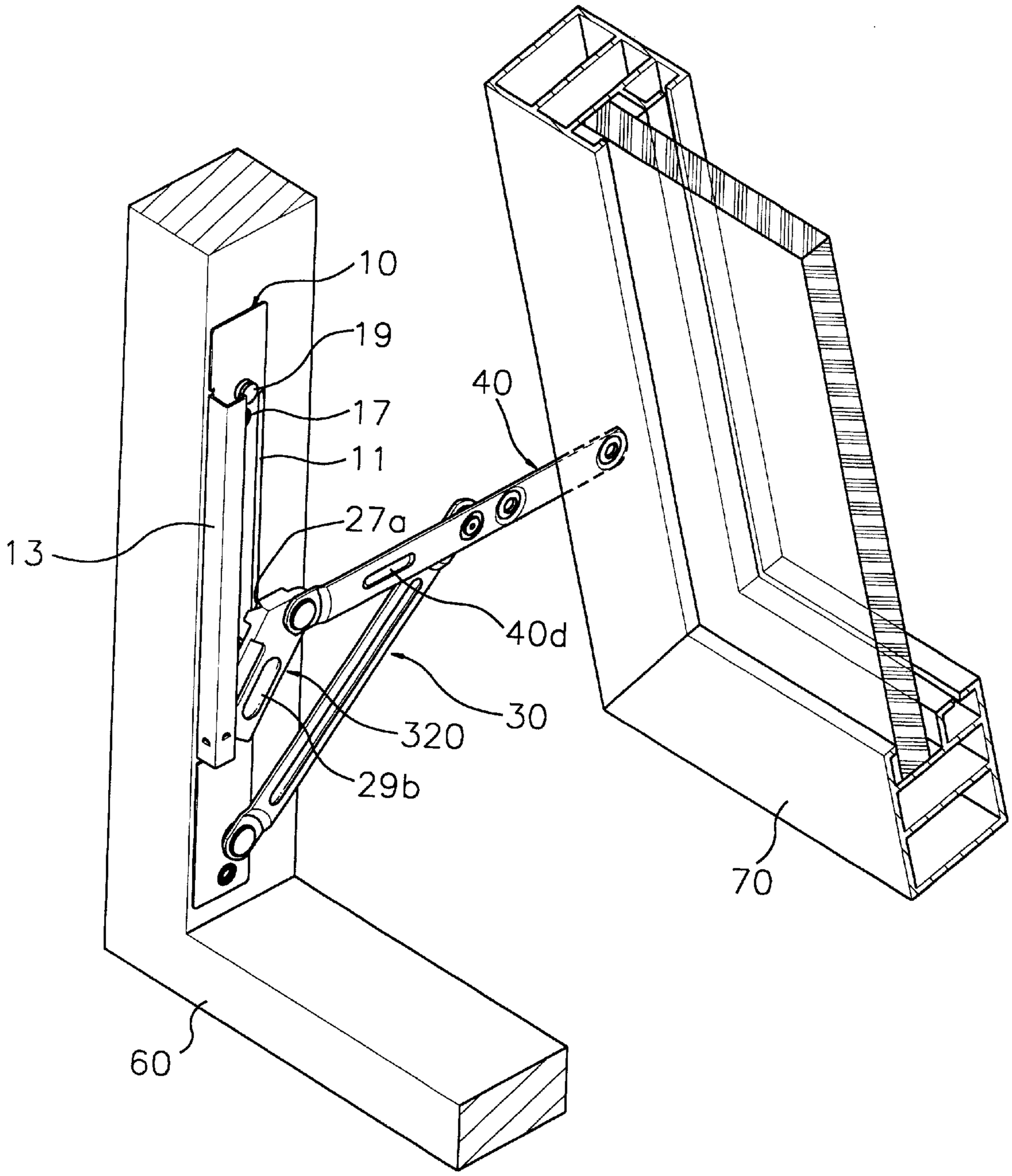


FIG.4A

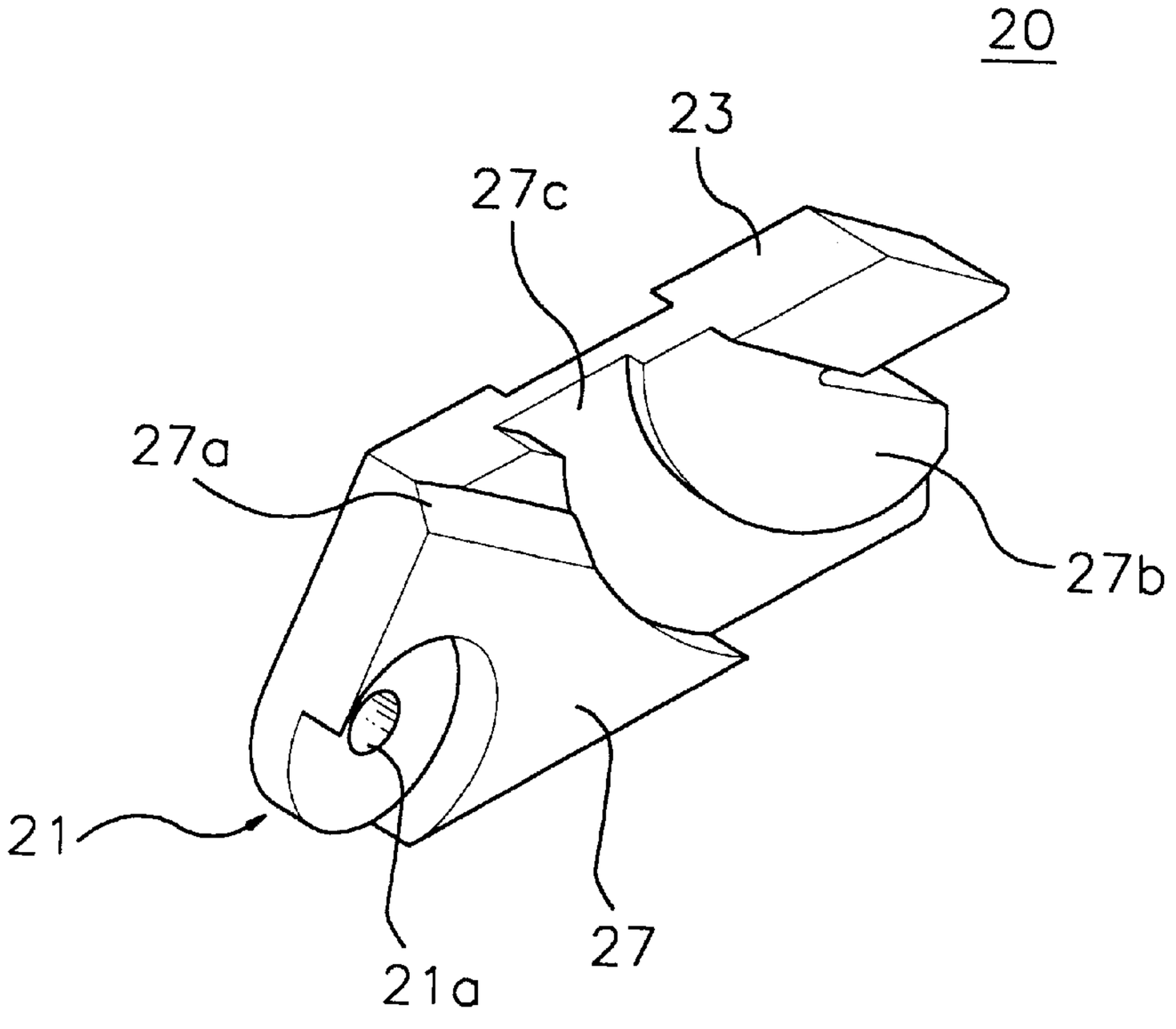


FIG.4B

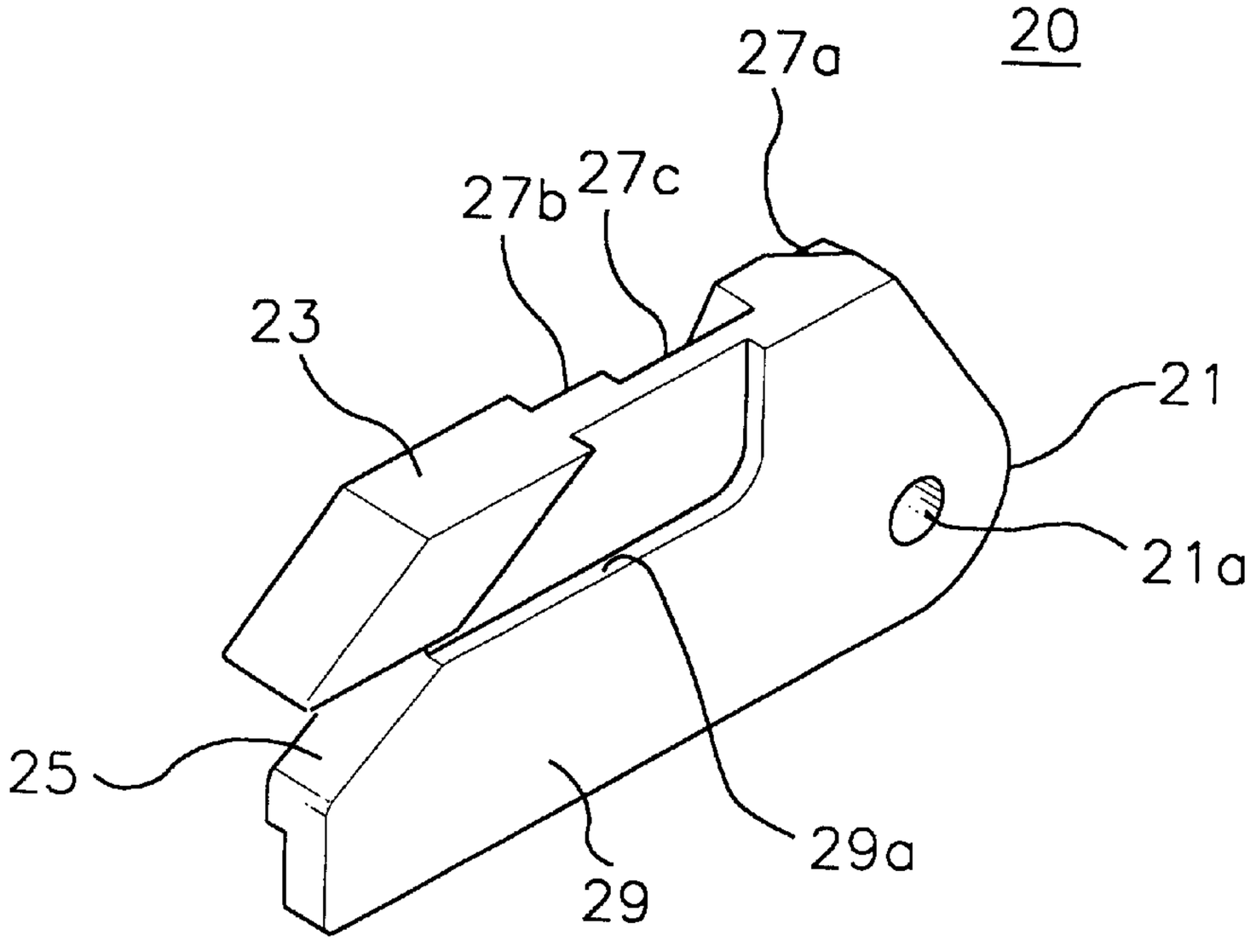


FIG.5A

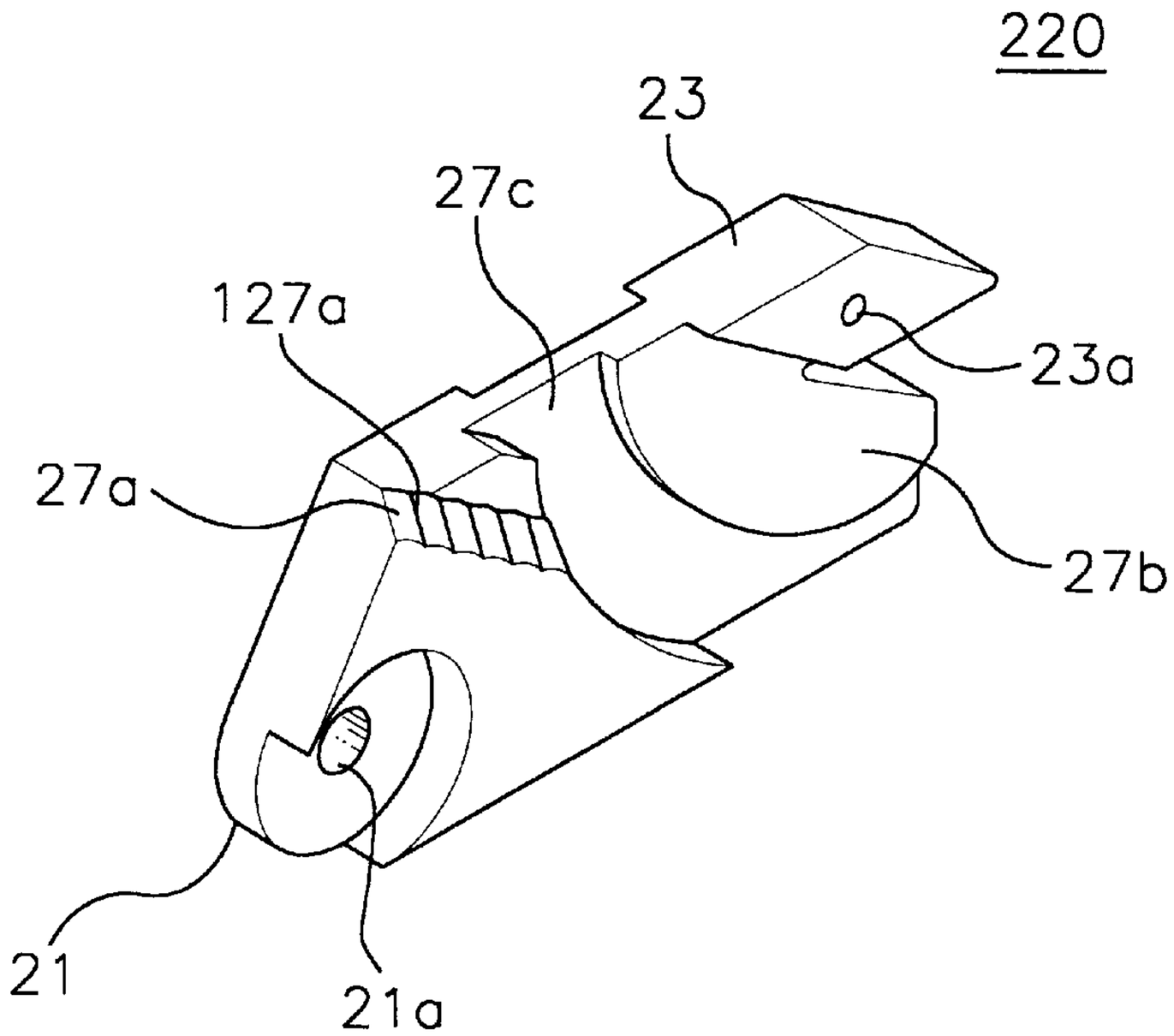

220
23
27c
127a
23a
27a
27b
21
21a

FIG.5B

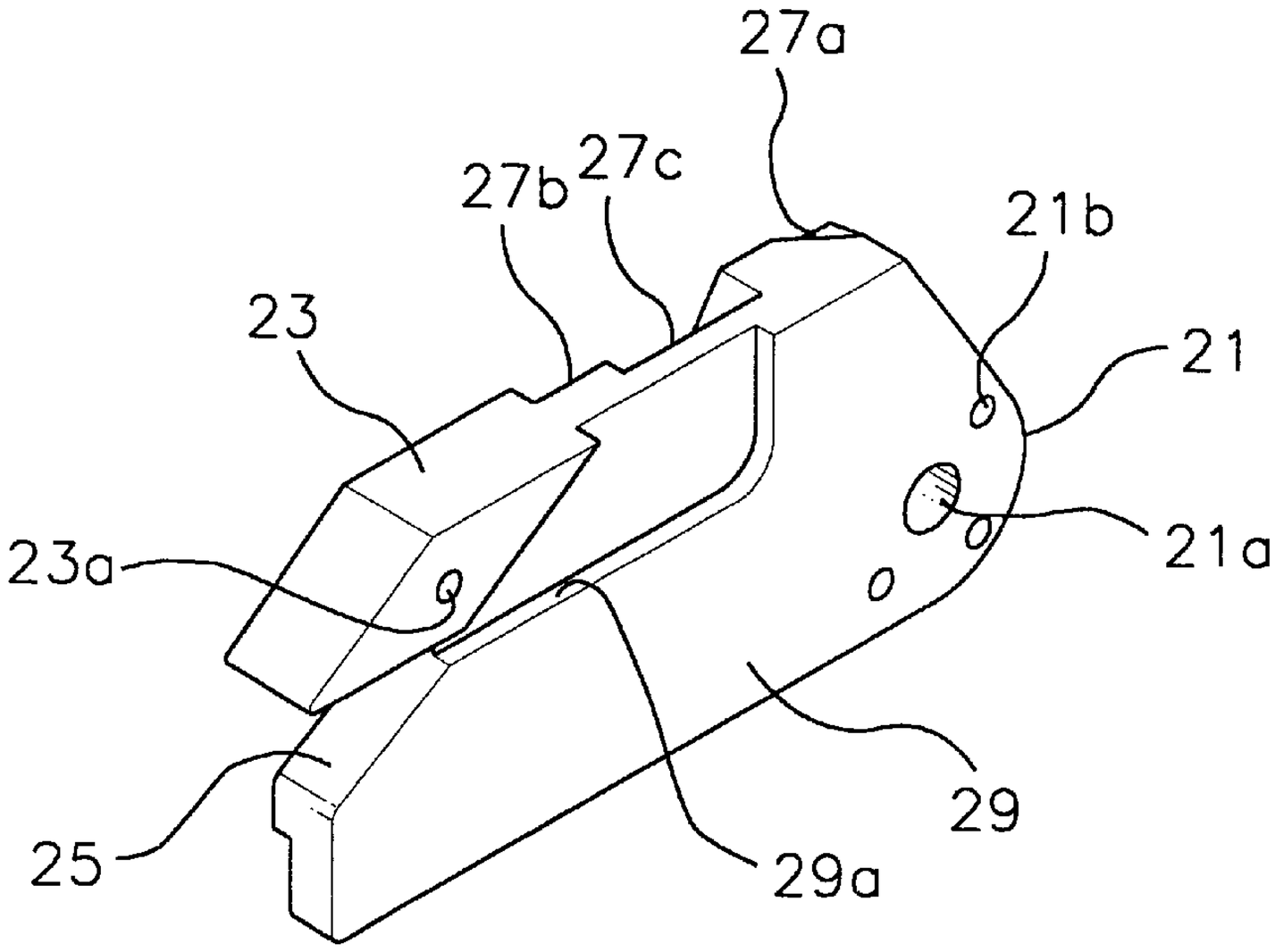

220
27a
27b
27c
21b
23
21
23a
21a
29
25
29a

FIG.6A

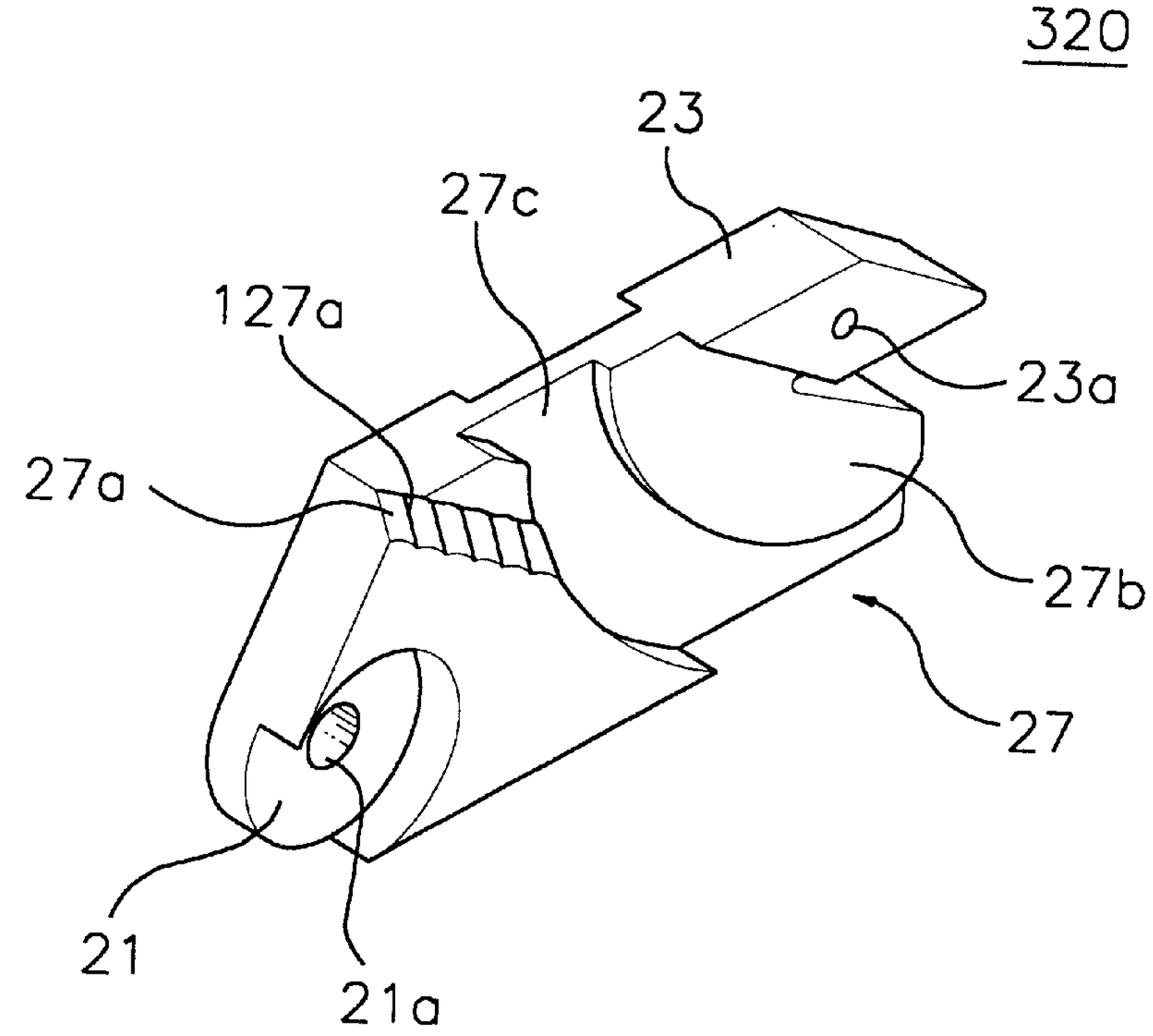

320
23
27c
127a
23a
27a
27b
27
21
21a

FIG.6B

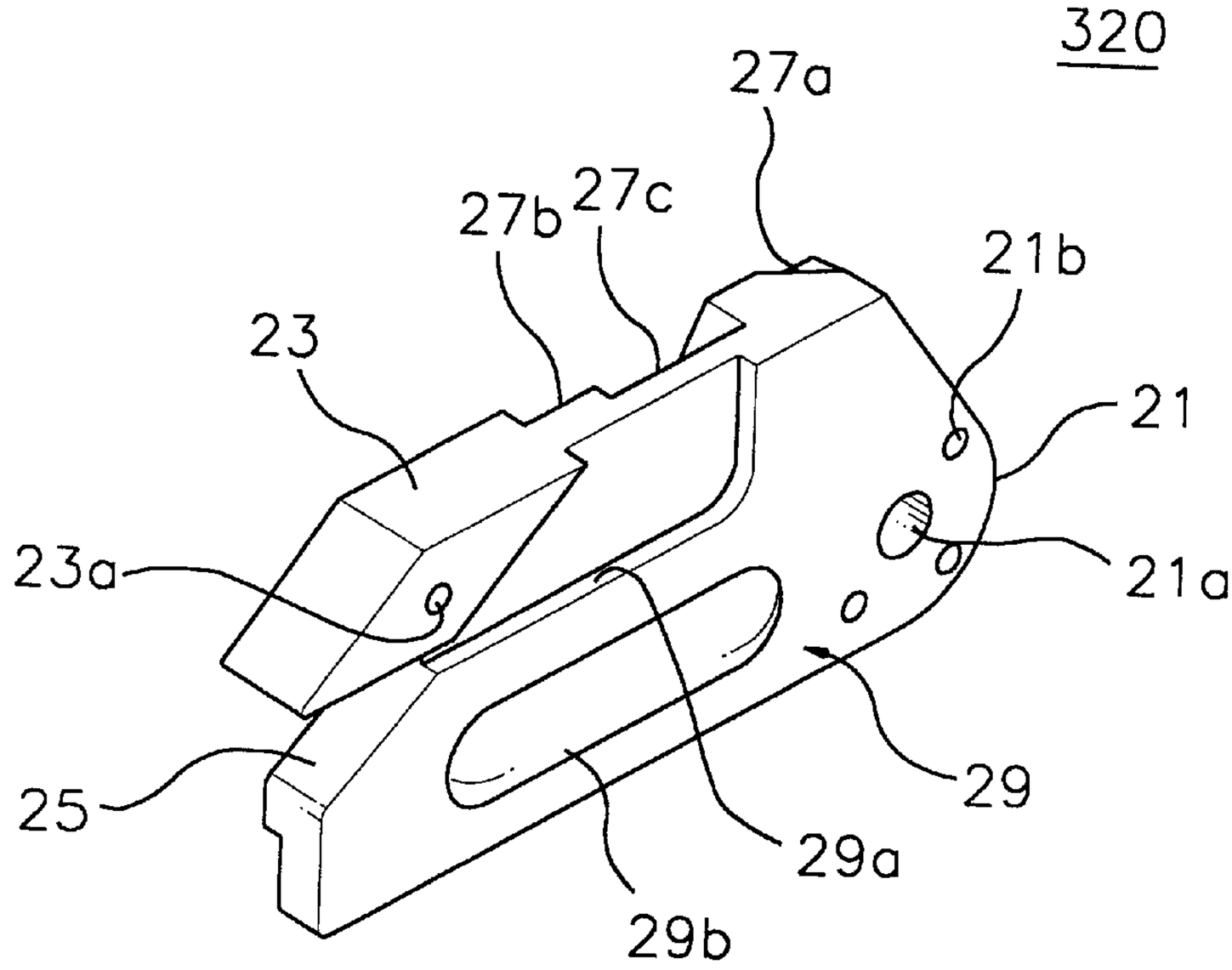

320
27a
27b
27c
21b
23
21
23a
21a
25
29
29a
29b

FIG.7A

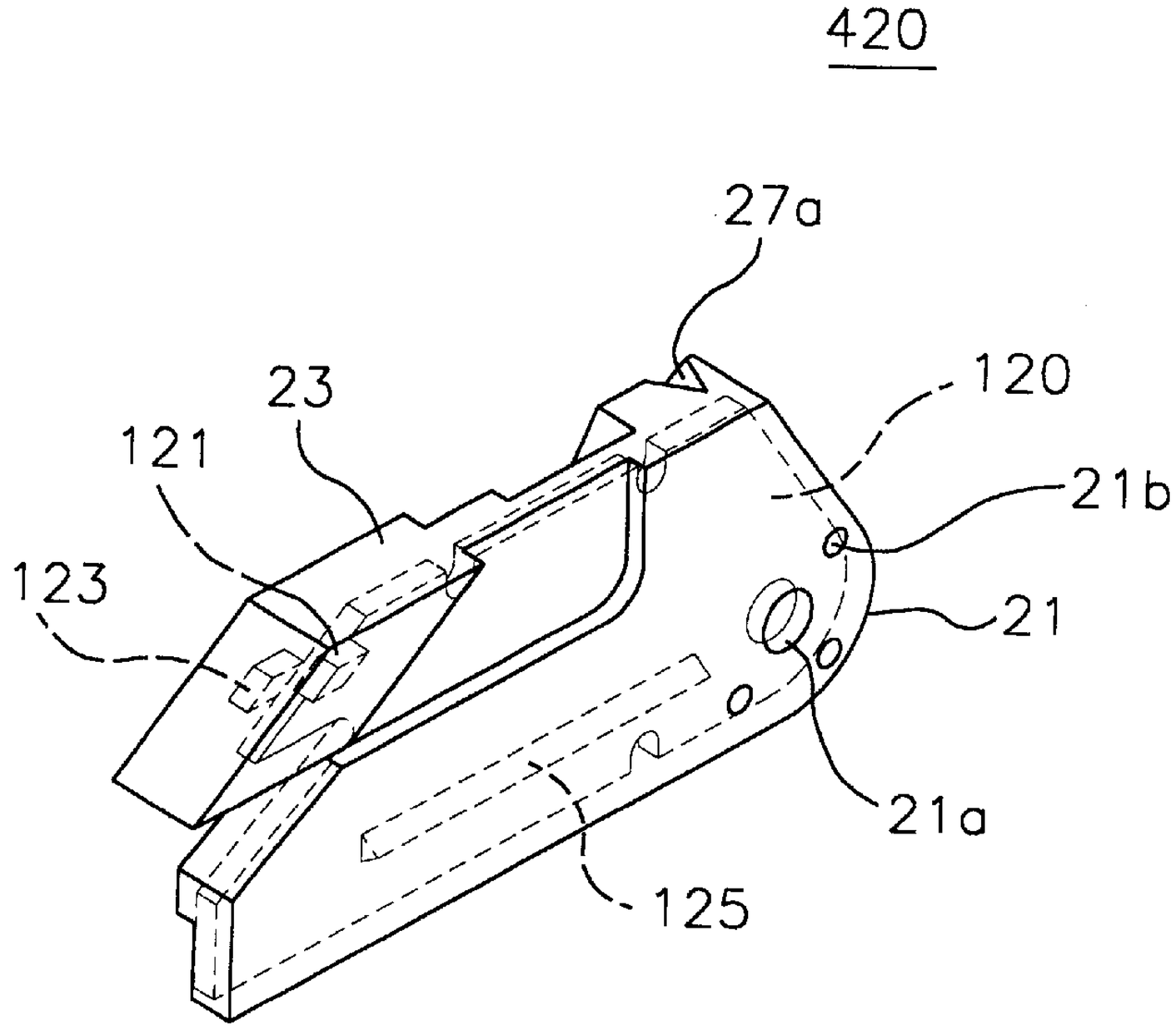

420
27a
23
121
120
21b
123
21
21a
125

FIG.7B

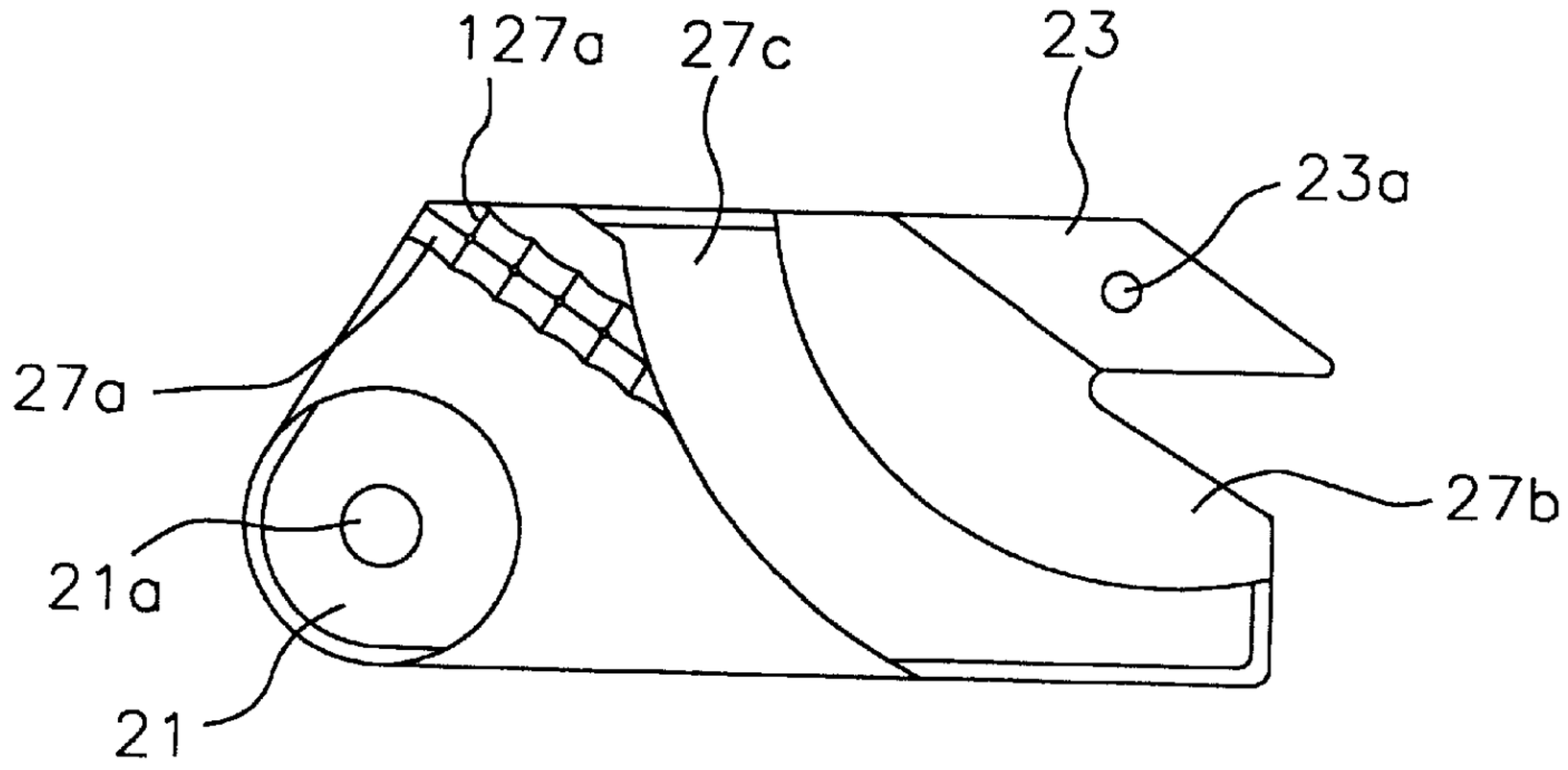

420
127a
27c
23
23a
27a
27b
21a
21

FIG.8A

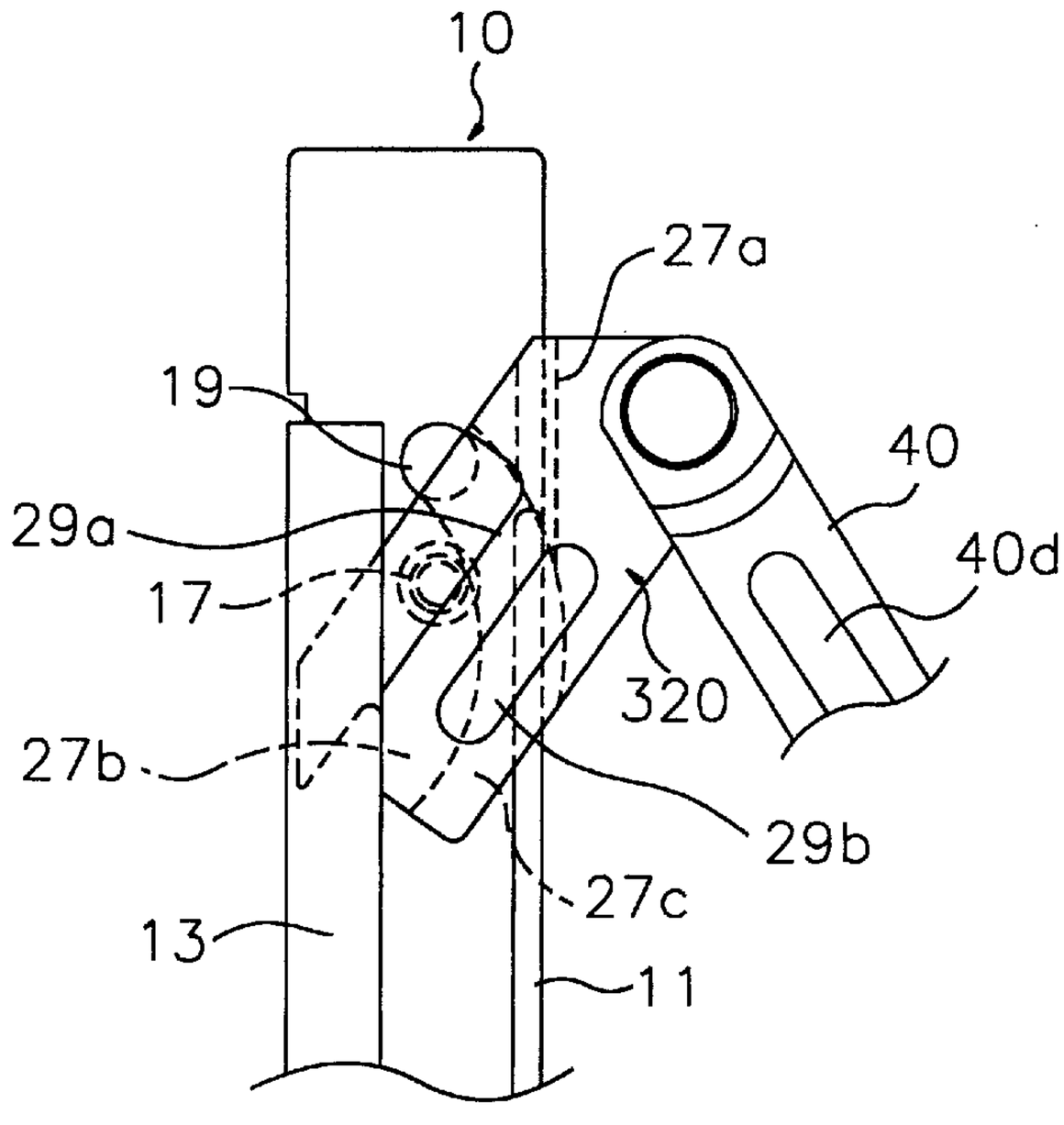
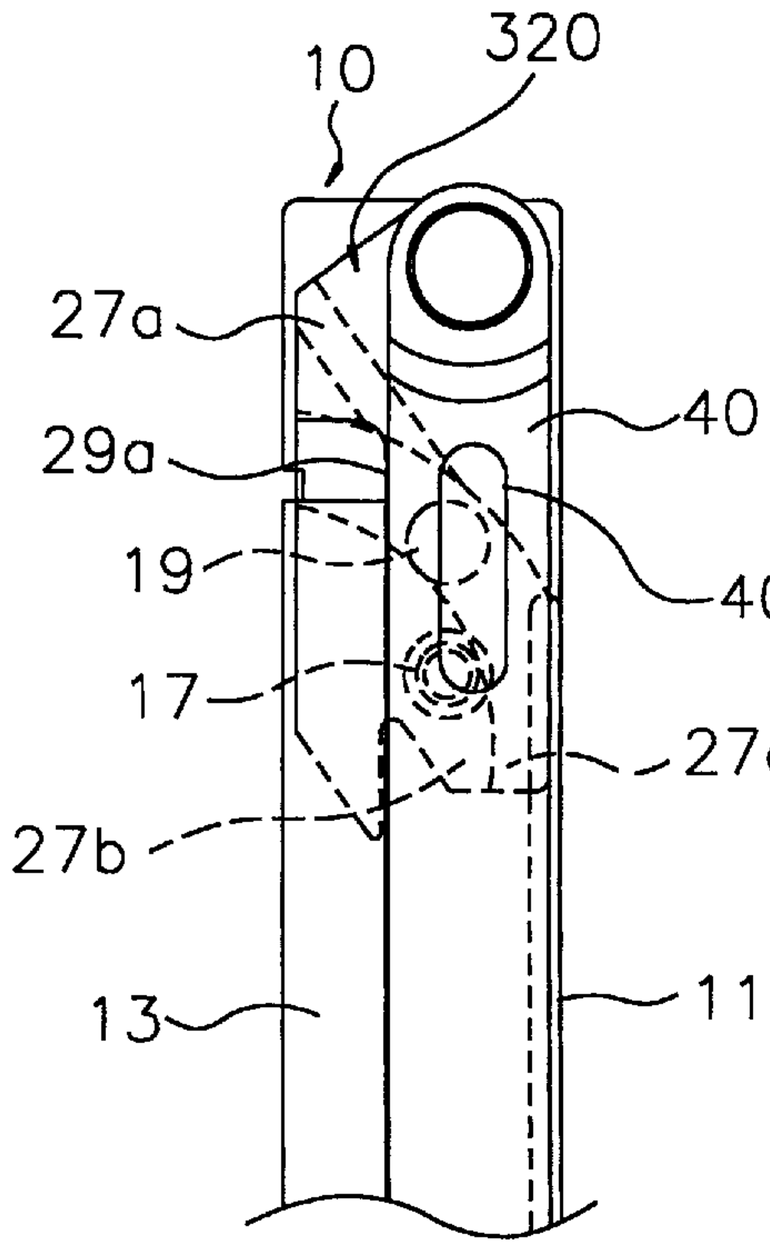

10
27a
19
40
29a
40d
17
320
27b
29b
27c
13
11

FIG.8B


10
320
27a
40
29a
19
40d
17
27c
27b
13
11

OPENING AND CLOSING APPARATUS OF FOLDING TYPE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an opening and closing apparatus, more particularly to an opening and closing apparatus of the folding type which opens and closes windows by moving a slider along with a guiding part according to a movement of two links hinged connected with each other.

2. Prior Art

Generally, an opening and closing apparatus of the folding type achieves an opened state by moving a movable frame apart from a fixed frame and a closed state by moving the movable frame toward the fixed frame. The opening and closing apparatus of the folding type can be employed with a top cover of a convertible automobile or windows.

The conventional opening and closing apparatus of the folding type includes a guide rail fixed on the fixed frame and links hinged on the guide rail. Each link is folded over the guide rail.

The conventional opening and closing apparatus as constructed above is described in detail according to the accompanying drawings.

FIG. **1** depicts the conventional opening and closing apparatus. As shown in FIG. **1**, the conventional opening and closing apparatus includes a guide rail A, a first link B, a slider C, a second link D, a third link E, and a fourth link F. The guide rail A is secured at a fixed frame (not shown). One side of the first link B is hinged on an upper side of the guide rail A and the other side of the first link B is hinged on a predetermined position of the fourth link F. The slider C is inserted into the guide rail A to move along with the guide rail A. One side of the second link D is hinged on a predetermined position of the first link B and the other side of the second link D is hinged on the slider C. One side of the third link E is hinged on the slider C, and the other side of the third link E is hinged on the fourth link F. One side of the fourth link F is connected to a movable frame (not shown). A stopper G installed at the lower end of the guide rail A engages the fourth link F when the conventional opening and closing apparatus is moved into the closed state.

Hereinafter, the operation of the conventional opening and closing apparatus will be described.

When the movable frame is moved apart from the fixed frame, the fourth link F rotates about the stopper G in a clockwise direction. The first link B rotates about the guide rail A in a counterclockwise direction. At that time, the second link D is rotated about a position hinged with the first link B in a clockwise direction, and thus the slider C moves upwardly along the guide rail A. Therefore, the third link E connected with the slider C rotates about the slider C in a counterclockwise direction. As a result, the movable frame moves apart from the fixed frame in a predetermined angle and achieves an open state.

Contrarily, when the movable frame is pulled toward the fixed frame to achieve a closed state, the fourth link F rotates about the third link E in a counterclockwise direction. At that time, the first link B rotates about the guide rail A in a clockwise direction, and thus the second link D rotates about the slider C in a counterclockwise direction. The slider C moves downwardly along the guide rail A, and thus the third link E rotates in a clockwise direction until the lower end of the fourth link F is stopped by the stopper G. As a result, the first link B to the fourth link F lie one upon another, and thus the closed state is achieved.

A drawback with the conventional opening and closing apparatus of the folding type is that the slider C experiences wear from repeated opening and closing which causes unwanted movement in the guide rail A.

In addition, the conventional opening and closing apparatus of the folding type also generates noise caused by friction between the guide rail A and the slider C as well as friction between the construction members thereof at hinged positions.

Furthermore, the conventional opening and closing apparatus of the folding type has difficulty remaining in the closed state because of the abrasion due to the friction between the construction members at hinged connection parts.

SUMMARY OF THE INVENTION

The present invention is proposed to solve the above problems of the conventional opening and closing apparatus of the folding type. It is a first object of the present invention to provide an opening and closing apparatus of the folding type which prevents the slider from joggling in the guiding part when the slider moves along with the guiding part fixed on the fixed frame. It is a second object of the present invention to provide an opening and closing apparatus of the folding type which prevents the apparatus from generating noise caused by the friction between the construction members therebetween. It is a third object of the present invention to provide an opening and closing apparatus of the folding type which can remain in the closed state.

In order to achieve the above objects, an opening and closing apparatus of the folding type according to the present invention includes a guiding part having a guiding protrusion formed in a longitudinal direction on one side of the guiding part, a guiding bend formed in parallel to the guiding protrusion and having a shape of a C, and a first connecting portion formed on a lower side of the guiding part. A slider is slidably connected with the guiding protrusion and the guiding bend for moving along the longitudinal direction of the guiding part. A first link has a second connecting portion hinged with the first connecting portion and a third connecting portion formed at an opposite side from the second connecting portion. A frame connecting part has a link-connecting portion connected with the third connecting portion, a slider connecting portion is slanted to the slider side centered about the link-connecting portion, and a frame connecting portion formed at an opposite side from the slider connecting portion centered about the link-connecting portion.

In preferred embodiments, the guiding bend further includes at least one stopper formed at a lower side of the guiding bend and protruding inside of the guiding bend.

The guiding part further includes a first fixing portion which protrudes from a face between the guiding protrusion and the guiding bend and a second fixing portion which protrudes at an upper side of the first fixing portion.

The slider includes a rotating part having a connecting hole to be hinged with the second connecting portion of the first link; a combining part inserted into the guiding bend to combine with the guiding bend and for moving it along the guiding bend; a slant formed at one side of the combining part along a slope; a sliding part having a groove for receiving the guiding protrusion, a first leading portion having a stairstep formation with the combining part to receive the first fixing portion, and a second leading portion

having a stairstep formation with the first leading portion to receive the second leading portion and continues from the groove; and a locking part formed at a rear side of the sliding part and having a stepped projection to receive the guiding bend when the slider moves toward a shutting position.

The rotating part includes at least one first friction reducing portion formed around the connecting hole to reduce friction forces between the slider and the second link when the rotating part cooperates with the second link.

The combining part includes a second friction reducing portion for reducing friction forces between the guiding bend and the combining part when the combining part connects with the guiding bend and moves along the guiding part. Ripples are formed on a wall of the groove.

The locking part further includes a locking protrusion protruding from the locking part toward the second link and having a dome shape. The second link includes a fixing protrusion protruding toward the locking protrusion to face each other and having a dome shape.

The slider is made of plastic and includes a reinforcing member made of metal which is inserted on the inside of the slider.

The reinforcing member includes a first reinforcing piece protruding from one face of the reinforcing member facing the combining part to reinforce the slider and a second reinforcing piece protruding from the opposite side of the first reinforcing piece to reinforce the combining part.

The present invention opening and closing apparatus prevents the slider from joggling in the guiding part by moving the slider having the rotating part and the groove along the guiding part.

Second, the slider has a friction reducing portion formed on each of the combining part, the groove, and the rotating part, which suppresses noise caused by the frictional operation between the components by putting oil into or on the frictional portion.

Third, the guiding part having the first and second fixing portions, the slider having the first and second leading portions, the locking protrusion, and the fixing protrusion, together, stably maintain the apparatus in the closed state.

Fourth, the reinforcing member having the first reinforcing piece and the second reinforcing piece is made of metal and provides the slider with more rigidity. Even though the plastic slider will melt in a fire, the metal reinforcing member will not melt, thereby keeping the opening and closing apparatus together and preventing secondary accidents caused by falling of the movable frame.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention. This invention will be better understood and its various objects and advantages will be more fully appreciated from the following description taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a perspective view for showing a conventional opening and closing apparatus of the folding type.

FIG. **2** is a perspective view for showing an opening and closing apparatus of the folding type according to the present invention.

FIG. **3** is a perspective view for showing the established state of the opening and closing apparatus of the folding type according to the present invention.

FIG. **4**A is a perspective view for showing a sliding part of a slider according to the first embodiment of the present invention.

FIG. **4**B is a perspective view for showing a locking part of the slider according to the first embodiment of the present invention.

FIG. **5**A is a perspective view for showing a sliding part of a slider according to the second embodiment of the present invention.

FIG. **5**B is a perspective view for showing a locking part of the slider according to the second embodiment of the present invention.

FIG. **6**A is a perspective view for showing a sliding part of a slider according to the third embodiment of the present invention.

FIG. **6**B is a perspective view for showing a locking part of the slider according to the third embodiment of the present invention.

FIG. **7**A is a perspective view for showing a slider according to the fourth embodiment of the present invention.

FIG. **7**B is a plan view for showing the slider according to the fourth embodiment of the present invention.

FIGS. **8**A and **8**B are views for showing an operational state of the opening and closing apparatus of the folding type according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Preferred embodiments of the present invention will be illustrated below with reference to the accompanying drawings.

FIG. **2** is a perspective view for showing an opening and closing apparatus of the folding type according to the present invention. FIG. **3** is a perspective view for showing the established state of the opening and closing apparatus of the folding type according to the present invention. FIG. **4**A is a perspective view for showing a sliding part of a slider according to the first embodiment of the present invention. FIG. **4**B is a perspective view for showing a locking part of the slider according to the first embodiment of the present invention. FIG. **5**A is a perspective view for showing a sliding part of a slider according to the second embodiment of the present invention. FIG. **5**B is a perspective view for showing a locking part of the slider according to the second embodiment of the present invention. FIG. **6**A is a perspective view for showing a sliding part of a slider according to the third embodiment of the present invention. FIG. **6**B is a perspective view for showing a locking part of the slider according to the third embodiment of the present invention. FIG. **7**A is a perspective view for showing a slider according to the fourth embodiment of the present invention. FIG. **7**B is a plan view for showing the slider according to the fourth embodiment of the present invention. FIGS. **8**A and **8**B are views for showing an operational state of the opening and closing apparatus of folding type according to the present invention.

Referring to FIG. **2**, the opening and closing apparatus **1** of the folding type according to the present invention includes a guiding part **10**, a slider **320**, a first link **30**, and a second link **40**.

The guiding part **10** includes a guiding protrusion **11**, a guiding bend **13** and a first connecting portion **15**. The

guiding protrusion **11** is formed in a longitudinal direction on one side of the guiding part **10**. The guiding bend **13** is formed in parallel to the guiding protrusion **11** and has a cross-sectional shape of the letter "C". On a lower side of the guiding part **13** stoppers **13***a,* **13***b* are formed which protrude toward the inside of the guiding bend **13**. The first connecting portion **15** is formed on a lower side of the guiding part **10** and is connected to the first link **30**. The guiding part **10** has a first fixing part **17** and the second fixing part **19**. The first fixing part **17** protrudes from a face between the guiding protrusion **11** and the guiding bend **13**. The second fixing part **19** protrudes at an upper side of the first fixing part **17**.

The slider **320** is connected with the guiding protrusion **11** of the guiding part **10** and the guiding bend **13** and moves in the longitudinal direction of the guiding part **10**. The slider **320** is preferably made of plastic.

The first link **30** includes a second connecting portion **31** and a third connecting portion **33**. The second connecting portion **31** is hinged with the first connecting portion **15** of the guiding part **10** by a first rivet **81**.

The second link **40** includes a link-connecting portion **41**, a slider connecting portion **43**, and a frame connecting portion **45**. The link-connecting portion **41** is connected with the third connecting portion **33** of the first link **30** by a second rivet **83**. The slider connecting portion **43** is slanted to the slider **320** side centered about the link-connecting portion **41**. The frame connecting portion **45** is formed at a side opposite to the slider connecting portion **43** centered about the link-connecting portion **41**. The slider connecting portion **43** is connected to a connecting hole **21***a* of the rotating part **21** formed on the slider **20** by a plastic washer **85**.

As shown in FIG. **3**, the opening and closing apparatus of the folding type **1** is installed on a fixed frame **60** and a movable frame **70**. The guiding part **1** is secured on the fixed frame **60**. The guiding protrusion **11** and the guiding bend **13** are connected to the slider **320**. The second link **40** is hinged with the slider **320**, the movable frame **70**, and the first link **30**. The first link **30** has the other side hinged with a lower side of the guiding part **10**. This embodiment discloses a window case, but other embodiments are also achieved.

Referring to FIGS. **4**A and **4**B, the slider **20** according to the first embodiment of the present invention includes a rotating part **21**, a combining part **23**, a slant **25**, a sliding part **27** and a locking part **29**. The rotating part **21** has a connecting hole **21***a* to be hinged with the slider connecting portion **43** of the second link **40**. The combining part **23** is inserted into the guiding bend **13** to combine with the guiding bend **13** and for moving along the guiding bend **13**. The slant **25** is formed at one side of the combining part **23** along a slope. The sliding part **27** includes a groove **27***a,* a first leading portion **27***b* and a second leading portion **27***c*. The groove **27***a* is formed in a shape of letter "V" or letter "U" for receiving the guiding protrusion **11**. The first leading portion **27***b* has a stairstep formation with the combining part **23** to receive the first fixing portion **17**. The second leading portion **27***c* has a stairstep formation with the first leading portion **27***b* to receive the second fixing portion **19** and continues from the groove **27***a*. The locking part **29** is formed at a rear side of the sliding part **27** and has a stepped projection **29***a* to receive the guiding bend **13** when the slider **20** moves to a shutting position. The slider **20** is preferably made of plastic.

To describe embodiments of the present invention, the same part of the invention appearing in more than one view of the drawing will be designated by the same reference character, and the description thereof is omitted to avoid the repetition.

Referring to FIGS. **5**A and **5**B, a slider **220** according to the second embodiment of the present invention includes all parts of the slider **20** according to the first embodiment of the present invention. The rotating part **21** of the slider **220** according to the second embodiment of the present invention further includes at least one first friction-reducing portion **21***b*. The friction-reducing portion **21***b* is formed around the connecting hole **21***a* to reduce friction forces between the slider **220** and the second link **40** when the slider **220** cooperates with the second link **40**. The combining part **23** further includes a second friction-reducing portion **23***a* for reducing friction forces between the guiding bend **13** and the combining part **23** when the combining part **23** moves by the guiding bend **13**. On the wall of the groove **27***a* of the slider **220**, ripples **127***a* are formed. The ripples **127***a* reduce the friction forces caused by the movement of the slider **220** along the guiding protrusion **11** of the guiding part **10** and use a path of the oil.

Referring to FIGS. **2**, **3**, **6**A and **6**B, a slider **320** according to the third embodiment of the present invention includes all parts of the slider **220** according to the second embodiment of the present invention. The locking part **29** of the slider **320** further includes a locking protrusion **29***b* protruding from the locking part **29** toward the second link **40**. The locking protrusion **29***b* is formed in a dome shape. As shown in FIG. **2**, the second link **40** according to the third embodiment of the present invention further includes a fixing protrusion **40***d* protruding toward the locking protrusion **29***b* to face each other. The fixing protrusion **40***d* is formed in a dome shape.

Referring to FIGS. **7**A and **7**B, a slider **420** according to the fourth embodiment of the present invention includes all parts of the slider **320** according to the third embodiment of the present invention and further includes a reinforcing member **120**. The reinforcing member **120** is preferably made of metal. The reinforcing member **120** has a first reinforcing piece **121**, a second reinforcing portion **123**, and a reinforcing protrusion **125**. The first reinforcing piece **121** protrudes from one face of the reinforcing member **120** facing the combining member **23** to reinforce the combining member **23** of the slider **420**. The second reinforcing piece **123** protrudes from the opposite side of the first reinforcing piece **121** to reinforce the combining part **23** of the reinforcing member **120**. The reinforcing protrusion **125** protrudes for fixing the reinforcing member **120** into the locking part **29** of the slider **420**.

Hereinafter, the operation of the present invention will be described referring to FIGS. **2**, **3**, **8**A and **8**B.

First, when the user wants to shut the window, the user pulls the movable frame **70** toward the fixed frame **60**. The second link **40** rotates in a clockwise direction centered about the link-connecting portion **41**, and thus the slider **320** moves toward the first fixing part **17** along with the guiding part **10**. At that time, the first link **30** rotates in counterclockwise direction centered about the first connecting portion **15**. When the second leading portion **27***c* of the slider **320** receives the second fixing portion **19**, the guiding protrusion **11** departs from the groove **27** as shown in FIG. **8**A. Therefore, the slider **320** rotates in a counterclockwise direction centered about a connecting portion between the guiding protrusion **13** and the combining portion **23**. At that time, the stepped projection **29***a* formed on the locking part **29** of the slider **320** receives an upper end of the guiding bend **12**, and thus the guiding part **10**, the slider **320**, the first link **30** and the second link **40** are positioned one upon another. At that time, the locking protrusion **29***b* and the fixing protrusion **40***d* cause the apparatus to be in a stable closed state.

Contrarily, when the user wants to open the window, if the user pushes the movable frame **70** toward the outside, the fixing protrusion **40***d* departs from the locking protrusion **29***b*, and thus the second link **40** rotates in a counterclockwise direction centered about the slider connecting portion **43**. At that time, the first link **30** rotates in a clockwise direction centered about the first connecting portion **15**, and the slider **320** rotates in a clockwise direction centered about a connecting portion between the guiding bend **13** and the combining part **23**. In regard to the slider **320**, the first fixing portion **17** and the second fixing portion **19** separate from the first leading portion **27***b* and the second leading portion **27***c*. When the second fixing portion **19** separates from the second leading portion **27***c*, the groove **27***a* receives the guiding protrusion **11**. The slider **320** continues to move itself toward the first connecting part **15** and then stops due to the stoppers **13***a*, **13***b*.

Effects of the opening and closing apparatus according to the present invention as constructed above will be described below.

The present invention opening and closing apparatus prevents the slider from joggling in the guiding part by moving the slider having the rotating part and the groove along the guiding part.

Second, the slider has a friction reducing portion formed on each of the combining part, the groove, and the rotating part, which suppresses noise due to the frictional operation between the components by putting oil into or on the frictional portion.

Third, the guiding part having the first and second fixing portions, the slider having the first and second leading portions, the locking protrusion, and the fixing protrusion, together, stably maintain the apparatus in the closed state.

Fourth, the reinforcing member having the first reinforcing piece and the second reinforcing piece is made of metal, and provides the slider with more rigidity. Further, even though the plastic slider will melt in a fire, the metal reinforcing member will not melt, thereby keeping the opening and closing apparatus together and preventing secondary accidents caused by falling of the movable frame.

While this invention has been particularly shown and described with reference to particular embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be effected therein without parting from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. An opening and closing apparatus of a folding type comprising:

a guiding part having a guiding protrusion formed in a longitudinal direction on one side of the guiding part, a guiding bend formed in parallel to the guiding protrusion and having a shape of a C, a fixing element extending from the guiding part near the guiding protrusion and the guiding bend, and a first connecting portion formed on a lower side of the guiding part;

a slider slidably connected with the guiding protrusion and the guiding bend for moving along the longitudinal direction of the guiding part, the slider being engagable with the fixing element and shaped to rotate while remaining engaged with the guiding bend and disengage from the guiding protrusion when the apparatus is moved into a shutting position;

a first link having a second connecting portion for being hinged with the first connecting portion and a third connecting portion formed at an opposite side from the second connecting portion; and

a frame connecting part having a link-connecting portion connected with the third connecting portion, a slider connecting portion slanted to the slider side centered about the link-connecting portion, and a frame connecting portion formed at an opposite side from the slider connecting portion centered about the link-connecting portion.

2. The opening and closing apparatus of claim **1**, wherein the guiding bend further comprises at least one stopper formed at a lower side of the guiding bend and protruding inside of the guiding bend.

3. The opening and closing apparatus of claim **1**, wherein the fixing element comprises a first fixing portion which protrudes from a face between the guiding protrusion and the guiding bend; and

a second fixing portion which protrudes at an upper side of the first fixing portion.

4. The opening and closing apparatus of claim **3**, wherein the slider comprises:

a rotating part having a connecting hole to be hinged with the second connecting portion of the first link;

a combining part inserted into the guiding bend to combine with the guiding bend and for moving along the guiding bend;

a slant formed at one side of the combining part along a slope;

a sliding part having the groove for receiving the guiding protrusion, a first leading portion having a stairstep formation with the combining part to receive the first fixing portion, and a second leading portion having a stairstep formation with the first leading portion to receive the second leading portion and continues from the groove; and

a locking part formed at a rear side of the sliding part and having a stepped projection to receive the guiding bend when the slider moves to a shutting position.

5. The opening and closing apparatus of claim **4**, wherein the rotating part comprises at least one first friction reducing portion formed around the connecting hole to reduce friction forces between the slider and the second link when the rotating part cooperates with the second link.

6. The opening and closing apparatus of claim **4**, wherein the combining part comprises a second friction reducing portion for reducing friction forces between the guiding bend and the combining part when the combining part moves by the guiding bend.

7. The opening and closing apparatus of claim **4**, wherein walls of the groove are formed with ripples.

8. The opening and closing apparatus of claim **4**, wherein the locking part further comprises a locking protrusion protruding from the locking part toward the second link and having a dome shape.

9. The opening and closing apparatus of claim **8**, wherein the second link comprises a fixing protrusion protruding toward the locking protrusion to face each other and having a dome shape.

10. The opening and closing apparatus of claim **4**, wherein the slider is made of plastic.

11. The opening and closing apparatus of claim **10**, wherein the slider further comprises a reinforcing member made of metal which is inserted on the inside of the slider.

12. The opening and closing apparatus of claim **11**, wherein the reinforcing member comprises:

a first reinforcing piece protruding from one face of the reinforcing member facing the combining member to reinforce the slider; and

a second reinforcing piece protruding from the opposite side of the first reinforcing piece to reinforce the combining part.

13. An opening and closing apparatus of a folding type comprising:

a guiding part having a first guide formed in a longitudinal direction on one side of the guiding part, a second guide formed in parallel to the first guide, a fixing element extending from the guiding part near the first and second guides, and a first connecting portion formed on a lower side of the guiding part;

a slider slidably connected with the first and second guides for moving along the longitudinal direction of the guiding part, the slider being engagable with the fixing element and shaped to rotate while remaining engaged with the second guide and disengage from the first guide when the apparatus is moved into a shutting position;

a first link having a second connecting portion for being hinged with the first connecting portion and a third connecting portion formed at an opposite side from the second connecting portion; and

a frame connecting part having a link-connecting portion connected with the third connecting portion, a slider connecting portion connected with the slider, and a frame connecting portion formed at an opposite side from the slider connecting portion.

14. The opening and closing apparatus of claim **13**, wherein the second guide further comprises at least one stopper formed at a lower side of the second guide.

15. The opening and closing apparatus of claim **13**, wherein the fixing element comprises a first fixing portion which protrudes from a face of the guiding part; and

a second fixing portion which protrudes at an upper side of the first fixing portion.

16. The opening and closing apparatus of claim **13**, wherein the slider is made of plastic.

17. The opening and closing apparatus of claim **16**, wherein the slider further comprises a reinforcing member made of metal which is inserted on the inside of the slider.

18. An opening and closing apparatus of a folding type comprising:

a guiding part having a guiding protrusion formed in a longitudinal direction on one side of the guiding part, a guiding bend formed in parallel to the guiding protrusion and having a shape of a C, a first connecting portion formed on a lower side of the guiding part, a first fixing portion protruding from a face between the guiding protrusion and the guiding bend, and a second fixing portion protruding at an upper side of the first fixing portion;

a slider slidably connected with the guiding protrusion and the guiding bend for moving along the longitudinal direction of the guiding part, the slider comprising:

a rotating part having a connecting hole to be hinged with the second connecting portion of the first link;

a combining part inserted into the guiding bend to combine with the guiding bend and for moving along the guiding bend;

a slant formed at one side of the combining part along a slope;

a sliding part having a groove for receiving the guiding protrusion, a first leading portion having a stairstep formation with the combining part to receive the first fixing portion, and a second leading portion having a stairstep formation with the first leading portion to receive the second leading portion and continues from the groove; and

a locking part formed at a rear side of the sliding part and having a stepped projection to receive the guiding bend when the slider moves to a shutting position;

a first link having a second connecting portion for being hinged with the first connecting portion and a third connecting portion formed at an opposite side from the second connecting portion; and

a frame connecting part having a link-connecting portion connected with the third connecting portion, a slider connecting portion slanted to the slider side centered about the link-connecting portion, and a frame connecting portion formed at an opposite side from the slider connecting portion centered about the link-connecting portion.

19. The opening and closing apparatus of claim **18**, wherein the guiding bend further comprises at least one stopper formed at a lower side of the guiding bend and protruding inside of the guiding bend.

20. The opening and closing apparatus of claim **18**, wherein the rotating part comprises at least one first friction reducing portion formed around the connecting hole to reduce friction forces between the slider and the second link when the rotating part cooperates with the second link.

21. The opening and closing apparatus of claim **18**, wherein the combining part comprises a second friction reducing portion for reducing friction forces between the guiding bend and the combining part when the combining part moves by the guiding bend.

22. The opening and closing apparatus of claim **18**, wherein walls of the groove are formed with ripples.

23. The opening and closing apparatus of claim **18**, wherein the locking part further comprises a locking protrusion protruding from the locking part toward the second link and having a dome shape.

24. The opening and closing apparatus of claim **23**, wherein the second link comprises a fixing protrusion protruding toward the locking protrusion to face each other and having a dome shape.

25. The opening and closing apparatus of claim **18**, wherein the slider is made of plastic.

26. The opening and closing apparatus of claim **25**, wherein the slider further comprises a reinforcing member made of metal which is inserted on the inside of the slider.

27. The opening and closing apparatus of claim **26**, wherein the reinforcing member comprises:

a first reinforcing piece protruding from one face of the reinforcing member facing the combining member to reinforce the slider; and

a second reinforcing piece protruding from the opposite side of the first reinforcing piece to reinforce the combining part.

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